

September 28, 2007

TO: R. N. Hill

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SUBJECT: Mass Flow Data for PEIS – Part II

Additional mass flow data have been requested by the USDOE and produced in the format for the GNEP Programmatic Environmental Impact Statement report. The requested data are for the CORAIL-Pu strategy and for a nuclear park containing LWR MOX and UOX cores. The data were obtained from previous work and structured into the requested format. This request complements a similar dataset provided in Ref. 1.

Brief descriptions of the two additional cases follow:

- CORAIL-Pu: Data for CORAIL-Pu equilibrium cycle [2] was used for this case. In the CORAIL-Pu strategy, plutonium content of the assembly is stabilized (i.e., the charge and discharge Pu contents of the assembly are about the same). The minor actinides (Np, Am, Cm and higher) are separated during fuel reprocessing between recycle passes and sent to waste storage.
- LWR UOX and MOX Park: Per request, the Pu material generated by LWR UOX cores is completely utilized by LWR full-MOX cores in an equilibrium mode. This translates to a park with ~90% LWR UOX and ~10% LWR MOX cores. For the full-MOX cores, the MOX pins are made using spent uranium from the PWR cores. One-pass of the plutonium through the LWR MOX core is assumed and the discharge is treated as LWR MOX SNF. Additionally, minor actinides in the discharge LWR UOX fuel are assumed to be high level waste. The data for this case come from the work summarized in Ref. 3. The uranium enrichment for the UOX core is 4.21% and the plutonium content in MOX fuel of the full-MOX core is 10.74%. Both cores have fuel discharge burnup of 50 GWd/t.

The summary data are contained in Table 1. For comparison purposes, the CORAIL-TRU results of Ref. 1 are included (a new "*Amount HLW to repository*" has been calculated for this case). Please note that the uranium enrichments for the CORAL-TRU and CORAIL-Pu strategies are 5.12% and 4.62%, respectively.

References

1. T. K. Kim, and T. A. Taiwo, "Mass Flow Data for PEIS," Intra-Lab Memorandum to R. N. Hill, September 5, 2007.
2. T. A. Taiwo, T. K. Kim, and M. Salvatores, "Feasibility Study of a Proliferation Resistant Fuel Cycle for LWR-Based Transmutation of Transuranics," ANL-AAA-027, Argonne National Laboratory, September 2002.
3. T. A. Taiwo, E. A. Hoffman and T. K. Kim, "Core Transmutation Data for Double-Tier Scenario Studies – Scenario 2," Intra-Lab Memorandum to Distribution, August 22, 2007.

Table 1. Mass Flow Data for GNEP PEIS.

| | CORAIL-TRU | CORAIL-Pu | UOX/MOX |
|--|--------------------|------------------|-----------------------|
| Reactor Power (GWe) | | | |
| LWR-UOX or HWR-UOX or HTGR-UOX | 0 | 0 | 90.21 |
| LWR-MOX/TRU or LWR-HWR | 100 | 100 | 9.79 |
| Fast Reactor | 0 | | |
| LWR-ThUOX | 0 | | |
| Uranium or Thorium Resource Requirement (Annual) | | | |
| Natural U Feed (MT/yr) | 16,346 | 14,807 | 15,288 |
| LEU, 3-5% (MT/yr) or 1% (HWR) | 1,495 | 1,495 | 1,780 |
| LEU, 19,9% (MT/yr) | 0 | | |
| Thorium-232 (MT/yr) | 0 | | |
| Depleted Uranium Unused (MT/yr) | 14,295 | 12,674 | 13,508 |
| SNF/ HLW / TRU Production / Cs/Sr storage / Recycled U storage (Annual) | | | |
| TRU Production in UOX (MT/yr) | 0 | 0 | 23.3 |
| Amount of TRU to waste (MT/yr) | 0.14 ^{a)} | 7.5 | 17.1 |
| Amount SNF to repository (MT/yr) | 0 | 0 | 193.2 |
| Amount HLW to repository (MT/yr) | 88.5 | 89.6 | 86.4 |
| Cs/Sr to decay storage (MT/yr) | | | Use Table 3.6-1 value |
| Recycled U to Storage | 1,958 | 2,023 | 1,491 |
| TRU Inventories (MT) | | | |
| In UOX LWRs or UOX HWRs or UOX HTGRs | 0.0 | 0 | 53 |
| In MOX-TRU LWRs | 573 | 260 | 85 |
| In Fast Reactors | 0 | | |
| In ThUOX LWRs | 0 | | |
| In SNF Storage | 0.0 | 0 | 435 |
| TRU Disposal (per 100 years of operation) | 14.1 ^{b)} | 752 | 1,706 |
| | | | |
| Thermal Load Reduction Factor (relative to No Action Alternative) | 82.2 | 1.8 | 1.1 |

a) 0.1% loss rate assumed during reprocessing;

b) From processing losses.